

Connecting ‘knowing that’ to ‘knowing how’: Knowledge Construction of Clinical Skills in a Problem-based Learning Medical Curriculum

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Abstract

Democratic changes in South Africa necessitated revised educational curricula across sectors. While these changes were important and necessary the results were not always positive, which led critics to dismiss the changes as ‘knee-jerk tinkering.’ The Problem-Based Learning Curriculum (PBL) introduced at the Nelson R. Mandela School of Medicine came under such criticism. This paper investigates that criticism by analysing experiences with the clinical aspects of the PBL curriculum on the part of the first cohort of students. The findings were analysed using critical discourse analysis, and the contextual differences between traditional and PBL curricula were analysed using Bernstein’s theories of classification and framing. The findings suggest that PBL must and should be informed by a deep understanding of the pedagogical underpinnings of such a curriculum as well as sound disciplinary content knowledge of medical skills. These two dimensions are not mutually exclusive. Hence, despite study participants’ concerns about the possible gaps in their basic sciences knowledge, they nonetheless expressed strong confidence in their clinical ability to cope with the realities of the severely underresourced South African health care context.

Keywords: Knowledge construction, problem-based learning, medical curriculum, clinical skills, Skills Laboratory

Introduction

In response to the democratic changes of 1994, various educational sectors

made radical changes to their curricula. The higher education sector was no different, and a case in point is the Nelson R Mandela School of Medicine (NRMSM) which replaced a traditional discipline-based curriculum with a problem-based learning (PBL) curriculum early in 2001. PBL shares a teaching philosophy with outcomes-based education, which was perceived to be an agent for the democratisation of education. The apartheid education system was criticised for promoting rote learning and undermining critical thinking (Allais 2003). Hence PBL emphasised not just theoretical knowledge, but how such theoretical knowledge can be used practically – in other words it connects ‘knowing that’ to ‘knowing how.’ The theme for the conference at which this paper was first presented, sought to focus on the varied challenges and critique of the new curricula being proposed in the light of the democratisation of the country. Using the PBL curriculum at the NRMSM as a case study, my central thesis in this paper is that ‘knee-jerk tinkering of the curriculum’¹ are not good enough and must be informed by a deep understanding of the pedagogical underpinnings of, in this case, a PBL curriculum, as well as sound disciplinary content knowledge of medical skills. As my findings will show, these two dimensions are not mutually exclusive.

Sketching the Context

Eighteen years into the new democracy, the South African health care system remains in a state of crisis (Dorasamy 2010). Both urban and rural health care facilities are acutely understaffed, under-equipped, and overloaded with patients. There has been a drastic increase in the number of patients being admitted daily into hospitals with tuberculosis and HIV-related illnesses. Due to the high crime rate and the high rate of motor vehicle accidents in South Africa, the numbers of trauma patients admitted to hospitals are also on the increase. Globally, statistics reveal that every minute of every day patients are rushed to hospitals with gunshot wounds, stab wounds and other traumatic injuries (World Health Organisation 2004). This crisis for medical

¹ This phrase was used in the conference call for papers at which this paper was first presented. The phrase refers to the almost reflex pedagogical responses to the democratic changes in the country which often resulted in curricula that may have been perceived to be not well thought through.

and emergency units in South Africa requires responsive doctors who are competently trained, and confident to perform clinical examinations and procedures on patients within the underresourced circumstances of the South African health care system.

It is within this context that the PBL curriculum was introduced at the NRMSM. The PBL curriculum, or Curriculum 2001 as it came to be known,

consisted of six modules in each of the five years of study. The curriculum content was presented as themes with generally one predominant theme running through a module. Students were also exposed early to clinical situations by undertaking clinical skills' training at the Skills Laboratory from the first year. According to the NRMSM *Faculty Handbook* (2001), the programme was designed to achieve the highest possible standard of education and training by stimulating and encouraging understanding rather than rote learning.

Curriculum 2001 used a method of learning in which students first encountered a problem, which was then followed by a student-centred enquiry process.... At the start of each theme, the students were given a theme book that served as a guide and consisted of time-tables, details of practicals, skills, large-group resource sessions and, most importantly, the problem for each week. The facilitators² were also given these books; however, their books contained the learning goals for the weekly paper cases while the students' books did not. The week was structured so that the paper cases in the small-group facilitation sessions took place early in the week. This meant that the problems would be presented without the student being given prior readings or lectures on the cases (Reddy 2010:22).

Taking as its subject the first cohort of students who registered for a PBL curriculum, this paper critically examines their experiences of learning the clinical aspects of the PBL curriculum and assesses their preparedness to work in underresourced healthcare environments. The focus extends to the participants' construction of medical knowledge and their ability to transfer this knowledge from a simulated clinical environment to the wide array of

² **Facilitator:** Non-expert who guided the PBL tutorials through a collegial, non-authoritative process to enable the students to achieve the learning goals for each of the paper cases through the 8-step PBL process.

authentic clinical settings encountered during their clinical education modules. One of the reasons that motivated the NRMSM to shift from its traditional discipline-based curriculum to a PBL curriculum was to address difficulties in the transference of the limited simulated clinical practice to real clinical contexts. The research reported on in this paper focuses on how the participants perceived the difference between the knowledge and practices that were expected by the two different kinds of curricula – traditional versus PBL – and how they reflected on their experiences during their clinical practice as students. Their knowledge of what was expected in the traditional curriculum was transmitted to them by the consultants in the wards who often, as will be seen below, made comparisons between the PBL students' knowledge and what had been transmitted in the previous curriculum.

Transferring from Simulated Clinical Practice to Real Contexts: The Challenges

The literature on medical education indicates that medical schools around the world struggle with the problem of developing authentic clinical practice in their curricula, (Geertsma & Van Der Vleuten 2008). The difficulties experienced by medical students and undergraduates in the transference of knowledge acquired in simulated clinical practice to real clinical contexts has been widely documented (Bradley & Bond 2006; Kneebone, Nestel, Vincent & Darzi 2007). The introduction of PBL at the NRMSM was prompted in part by clinicians' impressions that medical students were unable to transfer learning from the classroom to the clinical setting. Prawat (1989: 150) defines transfer of learning as the 'ability to draw on or access one's intellectual resources in situations where those resources may be required'. The clinical context provides an opportunity for students to show how their prior learning or understanding is brought to a new context.

With the traditional, discipline-based curriculum at the NRMSM students were exposed to two distinct educational paradigms: a theoretical paradigm (content-based theory) and a practical paradigm. During the first three years students had lectures and studied from textbooks. It was only during their fourth, fifth and sixth year when they attended clinical modules that they saw real patients whom they had read about earlier in their studies. Many studies reveal that when students are faced with real patients in the clinical setting, they are unable to connect the cold facts of 'knowing that'

with an interpersonal contextual ‘knowing how’ (Heliker 1994). With the PBL curriculum, students were introduced to clinical skills training in a Skills Laboratory (Skills Lab) from the first day of their student experience, unlike the traditional curriculum which took them to the wards only in the fourth year of the programme and where any prior simulated context they may have encountered in the programme up to that point was either non-existent or limited. The Skills Lab is a simulated educational facility in which a wide variety of medical professional skills are taught on models, mannequins and simulated patients. This was one of the ways in which the PBL curriculum sought to introduce the students early on in their studies to clinical situations that they would later deal with during their clinical modules at the hospitals. During their third, fourth and fifth years the PBL students attended clinical modules in the different disciplines of medicine at various hospitals across KwaZulu-Natal.

There have been numerous studies, both locally and internationally, on the use and advantages of clinical skills training in Skills Labs. A study by Docherty, Hoy, Topp and Trinder (2005) supported PBL in clinical situations and proved that students acquired clinical skills in the safety of the simulated environment that the Skills Lab provided. A study by Lee, Jacobs, Linberg, and Kumin (2005) reported that teaching in a simulated environment increased student confidence for learning clinical skills on newborns. Cohen-Schotanas *et al.* (2008) investigated the effects of traditional and PBL curricula on students’ general and clinical competencies. They tested the longitudinal effects of a PBL curriculum and of traditional learning related to students’ appreciation of curriculum, self-assessment of general competencies and summative assessment of clinical competence. They concluded that no differences were to be found between the cohorts during their clinical modules. So the question this paper seeks to answer is how did the PBL curriculum pedagogically prepare medical students for the real South African clinical context? Analysis of the experiences of learning from a sample of the first cohort of students who registered for the pilot PBL curriculum will be used to answer this question.

Methodology

The research on which this paper is based is located in a qualitative paradigm and uses critical discourse analysis (CDA) as an analytical lens to understand

the discursive power that was imminent in the participants' reporting of how they had constructed their medical knowledge through the PBL pedagogy. Purposive sampling was used and 21 participants were interviewed. The selected sample matched the race and gender norms of the NRMSM'S admission policy. The interviews were conducted when the participants had completed their undergraduate studies and were working as Community Service Officers at rural health care facilities. While the interviews related to the participants' experiences of the clinical aspects of their learning, inevitably they also referred to the other parts of the curriculum. This was perhaps especially inevitable given PBL's purported integration of theoretical and practical knowledge. The data thus also raised issues about the participants' construction and integration of theoretical content-based medical knowledge and their ability to apply this knowledge to the real clinical setting. All ethical considerations were complied with, including the use of pseudonyms to protect the identities of the participants.

A critical research approach was adopted, since critical researchers and theorists claim that knowledge is socially constructed. The notion of the social construction of knowledge is a fundamental tenet of democratised education, according to which the social world that we live in is understood as being constructed through social interaction and dependent on context, history, culture and custom. This social world is symbolically constructed in the minds of individuals who are to be understood not as standing 'before' it but as living in its 'midst'. McLaren (1986:312) states that 'when critical theorists claim that knowledge is socially constructed³, they mean that it is the product of agreement/consent between individuals who live out particular social relations (class, race, gender) and who live at particular junctures in time'. Hence the particular research paradigm opted for in this study, given the nature of curriculum changes made in response to democratisation.

It is only when one is in the middle of this socially constructed world that one is able to ask, 'how and why knowledge gets constructed in the way that it does, and how and why some constructions are celebrated by dominant culture while others are not?' (McLaren 1986: 312). Some forms of knowledge in this study were found to have more power than others, and the

³ This social-constructivist position can be in a weak or strong form. Many social-constructivists acknowledge a realist realm which impacts on the ways in which we socially construct our experiences of reality.

data indicate that in interactions between the participants and the consultants they worked with in the hospital wards the processes of knowledge construction which underpinned the participants' learning experiences in PBL pedagogy were frequently disparaged by the consultants whose knowledge had been framed within a traditional and long-established discipline-based pedagogy.

According to critical theorists, it is also the case that certain types of knowledge favour specific gender, class or race interests. Put in question form (as posed by McLaren 1986: 312): 'What interests does this knowledge serve? Who gets excluded from the knowledge? ... Who is marginalised?' In the context of this study, construction-of-knowledge issues arose in relation

- (a) to knowledge constructed at the medical school vis-à-vis knowledge constructed during the various subsequent levels of clinical education modules; and
- (b) how to account for some knowledge (knowledge constructed through the traditional medical curriculum) having higher status.

The CDA lens offered a means to interrogate the differential accrual of power through one or another of the two modes of knowledge construction (PBL versus traditional pedagogies). My findings, as stated earlier, point to three conclusions: 1) Teaching and practice of the PBL curriculum requires a deep understanding of underlying pedagogical principles; 2) The preparedness of PBL students to operate in a real-life clinical setting needs to be taken seriously; 3) Sound disciplinary content knowledge of medical skills is crucial to the practical real-life settings in which the students are expected to function.

Pedagogical Underpinnings of the PBL Curriculum

One of the main findings of my research is that, as reported by study participants, the consultants (medical specialists in a discipline who have oversight over the training of medical students in the authentic clinical setting) regarded the PBL students as lacking in basic science knowledge. In this regard, Bernstein's (2000) work on knowledge structures and the dimensions of power and control in pedagogic communication sheds useful

light on the divergent assumptions that come into play where (within a broader context of democratic political change) a traditional discipline-based medical curriculum, in place for almost fifty years, has been replaced by a PBL medical curriculum.

Bernstein (2000) provides a classificatory framework for questioning whether pedagogic communication may be influenced by patterns of domination intrinsic to education and, if so, what has made this possible (Muller 2008; Gamble 2006). Classification in this regard (Bernstein 2000) relates to levels of insulation between categories such as disciplines or bodies of disciplinary knowledge and their capacity to establish and maintain the boundaries that mask their identities. Of particular relevance to the present study is the distinction Bernstein makes between 'weak' classification (represented in his system by the symbol 'C-'), where a weak maintenance of boundaries and insulation between discourses results in a blurring of those boundaries, and 'strong' classification ('C+'), which occurs where the disciplinary discourse has a strong status and there is a high level of insulation between the categories of discourse.

The pivotal issue in the present case is the issue of status. In the traditional discipline-based curriculum, medical disciplines like Anatomy, Physiology and Pathology reflected 'strong' classification. The PBL curriculum, on the other hand, exhibits 'weak' classification of the disciplines in that these basic science disciplines are no longer taught as discrete modules but are instead 'inferred' when the students are presented with paper cases. The participants in the study, never having studied in a traditional curriculum where subjects were organised according to 'strong' classification lines, were consequently baffled by the vehemence of the dismissive comments which were made by some of the consultants in the wards and which reflect the classificatory system of the pre-PBL curricular discourse.

Framing, in Bernstein's terms, refers to the locus of control – who has control – in pedagogic practices over the selection, sequencing, pacing and evaluative criteria that govern knowledge. Framing regulates how the discourse is to be transmitted and acquired in the pedagogic context (Bernstein 2000). 'Strong' framing ('F+' in Bernstein's system) is where the teacher has total control over the selection, sequence, pace and evaluation criteria, and 'weak' framing ('F-') is where the learner has control over such issues of selection, sequence, pace and evaluation criteria of the pedagogic interaction.

The didactic lecture in the traditional curriculum at the NRMSM was an example of strong framing 'F+'. In this format, the lecturer was responsible for determining what was to be covered in the 45-minute lecture and went about delivering the lecture at his/her own pace with relatively little input from the students (usually in a large class of two hundred students). In the PBL curriculum, the student is accorded far more control of his/her own learning. The PBL tutorials are facilitated by non-experts who motivate the students to arrive at their own learning goals and subsequently research them in order to solve problems that are presented to them in the paper cases. This process requires self-directed learning techniques on the part of the students who determine their own pace in researching and mastering the knowledge. The PBL curriculum is thus an instance of weaker (F-) framing.

The study participants, who had experienced the 'weak' PBL framing during the first three years of the curriculum, constructed their knowledge discursively as being their own; they assumed their own power in making meaning of the medical knowledge. The interview data indicated reflection by the respondents on their engagement with particular problems and a development of emergent knowledge about the relevant procedures, but also that this was at odds with the more socially hierarchical expectations of the medical ward staff and that consultants would constantly silence them during the ward rounds and emphasise that they (the consultants) were in control of the teaching and learning process. This created a problem for the participants whose experience during the facilitation tutorials had been with a weaker framing that had given them more power over their own knowledge construction.

Applying Bernstein's distinctions to the empirical evidence emerging from the study sheds useful light on the resistance to the PBL curriculum, showing how the issues of power and control that were manifested in the ward translated into principles of communication that differentially regulated forms of consciousness in their production and in their capacity for change. These distinctions help us to understand what enables, legitimises and maintains the discordant pedagogic discourses that were apparent – in particular the hierarchical assumption ('consultant knows best') mediated through distributive rules, recontextualisation rules and evaluation rules (Bernstein 2000).

According to the participants' reports, the 'owners' of the pedagogy in the wards were the consultants who constructed their power discursively

and established their own representations through the use of the abovementioned rules, and in this way could control what would count as 'legitimate' knowledge. Some of the consultants used distributive rules to determine who had access to clinical knowledge in the wards, using the power accruing to them by virtue of the discipline to 'distribute' their medical knowledge to the different groups of students (traditional and PBL students), frequently controlling the kinds of access to medical knowledge of the study respondents could have. This can be further explained in terms of Bernstein's recontextualisation rules which regulate specific discourse formulation, constructing the classification and framing of the pedagogic discourses that I have described earlier. Respondent data indicated that the consultants who had been trained in a traditional curriculum and who had taught using the traditional methodology for most of their careers operated within strong classification and strong framing of the medical disciplines and were for this reason dismissive of PBL curriculum structures which eroded the teacher-learner hierarchy.

Bernstein's theory of knowledge structures usefully highlights the differences between traditional and PBL curricula structures in the way each emphasises particular knowledge, determines how it was taught and learnt, and who is responsible for driving the process of learning. Bernstein also distinguishes between two types of curriculum: the collection code⁴ curriculum and the integrated code curriculum, each made up of constituent units (or disciplines). In the traditional curriculum, for example, one unit was Anatomy, another was Physiology.

In the collection code type of curriculum (traditional curriculum) there are distinct boundaries to the units and each unit has a high degree of autonomy – in the Anatomy unit, for example, only Anatomy is taught – whereas in the integrated code type (PBL curriculum), blurring of boundaries occurs and content from each of the units overlaps. According to Bernstein, this kind of pedagogic practice is likely to be self-regulatory and allows for students' rights and status to be increased – in line with the philosophy of the NRMSM PBL curriculum, and with South Africa's constitutionally enshrined principles of democracy.

⁴ Collection code curriculum type: The traditional discipline-based curriculum was a collection code curriculum because there were distinct boundaries between each of the disciplines of medicine.

The power relations that the participants experienced in the wards created, legitimised and reproduced boundaries. From the classification and framing perspective, it was clear that the PBL curriculum favoured a weaker classification (C-) that resulted in the blurring of boundaries in basic science knowledge whereas the traditional curriculum was made up of self-contained disciplines through stronger classification (C+). Likewise, the framing of the PBL curriculum was weak framing (F-), in which the students were in control of the pacing of the curriculum (student-centred), while the traditional curriculum was emphatically lecturer-driven and didactic (F+). This mismatch in knowledge construction may in part account for the experiences of marginalization reported by the participants.

In restructuring and re-curriculating the study of medicine at the NRMSM, the curriculum developers weakened the classification between disciplinary boundaries in shifting from a collection-type curriculum model to an integrated-type curriculum model. The framing of curricular content in the new PBL curriculum was modified by rendering disciplinary principles of curricular regulation subordinate to external principles of regulation, which repealed the power and control that had previously accrued to individual disciplines. The move from collection-type to an integrated-type curriculum also had major consequences for organisational forms and power structures within the NRMSM. Individual department/disciplines no longer had total control over individual modules but were required to integrate their discipline content into the PBL format and a new School of Undergraduate Medical Education was created to organise and administer the new PBL curriculum.

Preparing Students for Real-life Clinical Settings through the PBL Curriculum

The main finding in the area of student preparedness is that, as reported by the respondents, the PBL curriculum prepared them adequately for real-life clinical settings. They cited their first encounter with clinical medical knowledge as having been in the Skills Lab where they were trained in clinical and medical skills in a simulated environment on specialised models and mannequins, but, while they saw this as a positive factor, they reported that the consultants did not share their sentiments. In the words of one participant,

We were labelled as students who learnt Medicine on dummies [models in the Skills Lab] (Gary: 12).

As reported by the respondents, consultants in the wards had a perception that students who had undergone the PBL curriculum did not know how to treat or examine real patients because they had spent too much time in the Skills Lab learning medicine on simulated patients and models⁵. This was directly counter to the participants' shared opinion that the Skills Lab had provided them with a safe learning environment in which to master the necessary physical examination techniques, communication skills and clinical/emergency procedures of the profession. The following participant comment spells out this conviction:

It's the skills that we learnt in a relaxed environment in the Skills lab that showed us what medicine was all about; it was an excellent introduction to the clinical examination (Sarah: 05).

The consensus among participants was that the clinical knowledge constructed in the Skills Lab enabled them to make the transition to the real clinical setting (where they then encountered a negative teaching environment).

The transfer of skills and knowledge from the Skills Lab to the real patients in the wards was undertaken without assistance from the medical ward staff. Although the participants were able to attain a level of confidence and competence in their clinical skills, they reported that the consultants nonetheless regarded them as having no sense of what medicine was all about. The following participant account indicates consultants' confusion in this regard when both the traditional and PBL cohorts were in their final year together.

The skills that we learnt in second and third year in the Skills Lab like abdominal exam and neurological exam made a huge difference when we did ward rounds with the old curriculum students. During

⁵ The comment that the students spent too much time learning on dummies suggests that the previous curriculum, which contained little to no practical training in the first three years, was preferred by the consultants.

the ward rounds the consultant would be teaching all the students at the bedside and would do these skills again. We felt advantaged over the old curriculum students because we had done them and were even examined on them in the OSCE⁶ so it was just revision for us (Gary: 12).

It was evident to the participants that the consultants belittling students for learning medicine on ‘dummies’ did not in fact know what clinical skills had been developed in the PBL curriculum Skills Lab. The comment just cited indicates, on the other hand, that the participants themselves felt positively advantaged clinically because the Skills Lab had already given them experience of physical examination techniques (on simulated patients and on each other), with further reinforcement of confidence and self-perception from successful completion of the OSCE clinical assessments that had also been part of their Skills Lab exposure.

The participants stated that they were not affected by the consultants’ negative remarks about their clinical skills abilities and the fact that they had trained on ‘dummies’ because they could see the benefits of being trained in a simulated clinical environment prior to the clinical education modules where they were exposed to live patients. They indicated that the PBL pedagogy and the training in the Skills Lab enabled them to transfer their clinical medical knowledge to the real clinical setting even during their clinical assessments in the wards.

The efficacy of PBL (which involves training in simulated clinical environments) has been a matter of concern for medical professionals globally, not just in South Africa, and there has been widespread research on whether PBL is an effective methodology for developing active, independent learners, divergent thinkers and good communicators. Bligh (1995: 120) has argued that,

The product of a PBL curriculum will be a doctor well versed in group problem solving, capable of working well independently, competent at using literature and statistical database to retrieve

⁶ OSCE: Objectively Structured Clinical Exam – a practical assessment of clinical skills (procedures and physical examination techniques) in the Skills Lab.

information and who is confident in his [sic] own professional ability.

Contrary to the scholarly view that the PBL curriculum creates more well-rounded doctors, consultants encountered by the participants had a broadly negative opinion of its outcomes:

The consultants said we were not going to make good doctors.

These differences of critique notwithstanding, one concern did however emerge that was expressed by both participants and consultants. This was the issue of content-based theoretical knowledge, or lack thereof, in the PBL.

Content-based theoretical knowledge

Study respondents reported that the classification and framing of the PBL curriculum was perceived by the consultants as failing to meet the required standards in regard to theoretical knowledge, and on this one point the students agreed with the consultants. The students themselves acknowledged gaps in their content-based theoretical knowledge of basic science, even though they felt confident and competent in performing clinical examinations and procedures on real patients, and they reported that they were constantly subjected to negative comparison with traditional curriculum students in regard to basic science knowledge:

The old curriculum students did basic sciences over three years. For example they did an entire year of Anatomy, Physiology, Pathology. We had it all combined in the problems from first to third year. We were looked down upon because of this (Patricia: 04).

In the traditional curriculum, Anatomy was studied in parallel with Physiology and formed a basis for the subsequent study of Pathology and the other clinical disciplines. With the integrated approach to learning in the PBL curriculum, the problems in the first three years of the programme were designed to be vehicles for the learning of these basic science disciplines. The Theme Design Group appointed by the Medical School had the task of integrating all requisite basic sciences objectives into the set of clinical cases for each designated theme. The envisaged approach was to create a spiral structure introducing basic science concepts at an early stage which would

subsequently be revisited in greater depth at regular intervals across the entire curriculum (NRMSM Faculty Handbook 2001).

The participants' impressions, as reported, were that many of the consultants in the wards had had little or no involvement in the design and development of the PBL curriculum for the first three years of the programme. It may therefore be the case that the consultants were unaware of what basic sciences had in fact been covered by the participants in their small-group tutorials. According to the participants, the consultants expressed serious concerns about the lack of basic science knowledge and regarded them as having a deficient foundation for medicine. They reported that the consultants regarded the PBL curriculum as inadequate preparation for the clinical setting as against a strong content-based theoretical foundation. Participant Jane commented that she knew exactly why the consultants did not like the new curriculum:

It was because we were no longer required to perform complete dissections of the human body and we were not taught Biochemistry, Microbiology, Clinical Pathology, Virology etc. (Jane: 15).

The issue of inadequate basic science knowledge construction in the PBL curriculum is further exemplified by participant Mary's experience:

I remember this time in 4th year when I presented a case on pneumonia and the questions that I got asked (of course, we hadn't done that much Microbiology, we had just touched on it in 2nd year), but the question was 'name all the organisms that can give you a cavitating pneumonia?' Oh, I just stood there and laughed 'cos, I only knew klebsiella. The rest of the discussion, the consultant just blurted, 'I don't know why you don't know this! This is basic 2nd year stuff. How are you going to be doctors?'' (Mary: 14).

The concern about adequate coverage of the basic sciences in the PBL curriculum is also raised in the literature on PBL: two principal issues are (a) its ability to provide adequate coverage of the curriculum content, and (b) the time requirement for both faculty and staff (Barrows 2000; Dolmans & Schmidt 1996). However, Dolmans and Schmidt (1996) also claim that PBL curricula encourage the integration of knowledge from different domains, for

example, biochemical and medical domains, which is reported as an advantage of PBL. They go on to say that PBL students should be more able than others to integrate basic science knowledge when they encounter similar problems in real clinical contexts. I argue that my study revealed that this learning did not occur because the participants themselves acknowledged the limitations in their knowledge of the basic sciences, as in the comment by participant Shaun that,

when it came to discussing the theory behind it, I wasn't confident about whether I knew enough about the topic.

This raises the question of whether all the basic sciences objectives were in fact covered in the PBL cases during years one to three of the curriculum, and a second question is whether the participants were actually able to assimilate all the basic science knowledge via the small-group tutorial process at medical school. The data revealed a degree of uncertainty around these issues on the part of the respondents, who were not in a position to comment on whether the core knowledge of the basic sciences had indeed been covered during the five years of the degree programme.

Two factors that might possibly account for the content-based theoretical inadequacy that was reported by the participants, despite integration of the basic sciences in the various themes that make up the structure of the PBL curriculum at the NRMSM, are (a) that in each of the first three years the basic science concepts were all presented in the context of clinical problems and this may have led students to pay more attention to the clinical and contextual aspects of the problems and neglect the underlying basic science knowledge; and (b) that in years three and four of the curriculum, there were study participants who attended their clinical education modules at other hospitals, external to the PBL sessions (themes and tutorials) running concurrently at the medical school. Participant Niki was one respondent who noted this disjunction:

I was in a clinical block that was completely unrelated to the theory we were doing in the themes. I was doing Paediatrics in the Block and doing Body in Motion in the theme ... totally confusing (Niki:11).

It is possible that course-design factors such as these may have impacted negatively on the participants' construction of the content-based theoretical aspects of their medical knowledge and ability to integrate basic sciences knowledge with the clinical problems they were encountering in the real-life clinical setting.

The traditional curriculum at the NRMSM was a collection-type curriculum where power and authority remained within the discipline department. Selection, sequencing and pacing of the content were governed internally by each disciplines. The PBL curriculum, on the other hand, was an integrated-type curriculum which called for staff from the different disciplines to work together in establishing horizontal and equal curricular relationships instead of the hierarchical relationships maintained in the traditional curriculum with its 'strong' classification of disciplinary integrity. This produced more complex patterns of power and authority, requiring a strong social network with collegial sub-communities in place to question the goals of the programme. Staff consensus was also required on what should count as valid/core knowledge and why and how it should be recognised in the programme – a PBL curriculum is dependent on teaching staff being able to embrace a common epistemology (Moore 2002). Whether any such shared epistemology existed among the consultants in the hospitals is questionable in the light of participant responses, with many reporting that the consultants did not understand the structure of the PBL curriculum and were critical of its intentions.

From the literature it can also be seen however that some of the consultants' concerns about content-based theoretical expertise and the PBL medical curriculum need to be carefully considered. Muller (2008:25) argues that proponents of PBL 'are clearly trying to bend the medical stick towards the contextual side by emphasising the contextual problem to be solved rather than the disciplinary knowledge to be learnt'. He describes PBL curriculum design as having an external contextual coherence instead of an internal conceptual coherence. Table 1 indicates the differences between these two curriculum structures at the NRMSM.

Muller (2008) argues that gaps in student knowledge can arise when sequential requirements are ignored and that there are limits to contextualising the curriculum of a vertical discipline in the Bernsteinian sense because of the greater sequential coherence that is required by such a discipline. *Sequence* should be a foremost concern in order to maintain the

necessary congruence with the vertical spine of the parent discipline. Omission of the basic sciences leads to chunks of core knowledge being missed completely, leaving gaps in content-based theoretical knowledge such as those reported by the participants.

Table 1: Conceptual vs. contextual coherence in traditional/PBL curriculum structures at NRMSM

| Internal conceptual coherence (traditional curriculum – ‘knowing that’) | External contextual coherence (PBL curriculum – ‘knowing how’) |
|---|--|
| <ul style="list-style-type: none">• High codification – presumes a hierarchy of abstraction and conceptual difficulty | <ul style="list-style-type: none">• Segmentally connected where each segment is adequate to a context, sufficient to a purpose |
| <ul style="list-style-type: none">• Vertical curriculum (‘strong’ classification and framing) – requires conceptual coherence, and sequence matters | <ul style="list-style-type: none">• Sequence is of less importance (‘weak’ classification and framing) – coherence to context is important |
| <ul style="list-style-type: none">• Regulated by adequacy to truth (logic) | <ul style="list-style-type: none">• Regulated by contextual adequacy to a specialised form of practice |

Adapted from Muller (2008).

Muller’s critique may help to explain why the participants felt a sense of content-based theoretical inadequacy during the ward rounds of the clinical education modules in years three, four and five of the PBL curriculum⁷. It may also shed light on the reaction of the medical ward staff to the participants’ theoretical knowledge, or lack thereof, and it suggests that

⁷ An alternative explanation may be that ‘participants’ feelings of inadequacy may have stemmed from their being repeatedly told that their learning up to that point was inadequate, by consultants who were unwilling or unable to provide the continuing teaching of basic science information in context of clinical problems.

cultivation among staff of a sense of common endeavour underpinning a shared PBL epistemology may not have been given sufficient attention⁸.

The participant response data indicate that the structure of the PBL curriculum directly impacted on the participants' experiences of learning the clinical aspects of the medical curriculum with ensuing effect on their construction of medical knowledge of clinical skills.

Conclusion

This paper has explored issues of power and pedagogy in a PBL curriculum intended to develop the necessary clinical preparedness for the study participants to function as medical practitioners within the context of South Africa's severely underresourced healthcare environments. The main argument for a PBL curriculum is that doctors-in-training need to be exposed as early as possible to working in a real-life clinical setting, particularly when that setting is underresourced. Simulated clinical environments and problem-posing education, introduced at the very start of the first year, seems to be able to achieve this, from what was reported by the student participants in the study.

However, this paper has highlighted two areas of concern. The first is pedagogic: not all of the stakeholders subscribe to the pedagogical underpinnings of the PBL curriculum – as was demonstrated by consultants' negative opinion of students emanating from this curriculum. Bernstein's theory suggests that these discordant views have more to do with who has power in the construction of knowledge than with the content of the curriculum.

The second concern is epistemological: it has to do with the way knowledge is constructed in the PBL curriculum, and points to the danger of 'throwing the baby out with the bathwater.' In other words, curriculum developers need to be cautious that in moving towards a more contextual approach they do not

⁸ It could be argued that the consultants expected the same layered teaching and learning as they and previous generations of students had experienced, and thus tried to provide clinical teaching only, and could not supply the necessary basic science integration at that level'. I am grateful to the reviewer of this paper who pointed out this valuable insight during the peer review process.

abandon disciplinary integrity – that the learning of basic sciences needs to continue in the clinical context. The study participants concurred with the consultants that some of the content-based theoretical knowledge needed to be specifically re-incorporated into the PBL curriculum rather than being taken for granted. Despite the participants' concerns about the possible gaps in their basic sciences knowledge and their reports of the consultants' dismissive attitudes towards the PBL curriculum, the study indicated that the participants nonetheless felt strongly confident in their ability to cope with the practical clinical realities of working in the underresourced South African healthcare system.

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